life history of the Caspian region closely resembles that of our salt lake districts. On the mountain slopes the steppes pass rather rapidly into forests. The steppes are best developed near the Black sea, while the halophytes and artemisias are more abundant toward the Caspian sea. Smaller and similar steppes are found south of the Caucasus, paths of migration occurring along the Caspian shore.

The second and third chapters have to do with the luxuriant forests of Colchis near the shore of the Black sea, south of the Caucasus, and the similar forests of Talysch near the Caspian. These forests enjoy a mild maritime climate and are largely of the Mediterranean evergreen type (Schimper's sclerophyll forests), in which the cypress, laurel, olive, arbutus, ilex, etc., are abundant, as well as a few deciduous trees; conifers are scarce. Some species now endemic in Colchis were widespread before the ice age, so that Wettstein believes that this region was a prominent place of refuge in the Pleistocene. Conditions are similar in Talysch, except that conifers are wholly absent. Other Caucasian forests are described in the fourth chapter. Western Caucasia has more forests than the eastern part of the district, a consequence of climatic differences. Ascending the mountains, one sees the Paliurus maqui pass into true forests of deciduous trees and conifers like those of Europe. Higher up are great Rhododendron thickets.

Xerophytic rock plants are treated in the fifth chapter. The characteristic forms are Persian, such as Astragalus and Acantholimon, and decrease northwestward as the climate becomes moister. Lists of calcicoles and silicicoles are given, but Radde tends to minify their importance. The next chapter is concerned with the mountain floras, which reach a high development in Caucasia. The snow and timber lines are much lower in the west Caucasus region than farther east because of the high precipitation, but there is no difference between the north and south slopes. The subalpine regions have a dense vegetation, in which Rhododendron takes an important place. In the alpine regions plants are scattered, and at least two species complete their life cycle a thousand feet above the snow line. Sphagnum bogs are confined to the alpine regions. The last two chapters contain phenological data and a floristic subdivision of the Caucasian region.—H. C. COWLES.

NOTES FOR STUDENTS.

K. SHIBATA has made an extended study of the course of growth and of the changes which occur in the reserve food during the development of the shoots of the bamboo.[6] These observations supply many details in the knowledge of the life history of *Phyllostachys mitis* and the other species used for comparative study.—C. R. B.

A VERY READABLE account of statistical methods as applied in biology is

[6] Jour. Coll. Sci. Imp. Univ. Tōkyō 13: 427–502. *pls. 22–24.* 1900.

given by Whitney.[7] He describes especially the curves and charts of Karl Pearson based on the theory of probability. Very suggestive advances are being made in the manner in which masses of data may be handled and expressed in simple form.— B. M. DAVIS.

HABERLANDT reports[8] that he has confirmed the observations of Němec[9] as to the existence of longitudinal fibrils in the protoplasm of plerome cells in Allium and Aspidium. He has identified these structures in living and in fixed tissues, but is not able to distinguish the sheath which Němec asserts to be present. He dissents, however, from the view that these are for the conduction of stimuli, and suggests that they serve rather for transport of plastic material.— C. R. B.

IN A THIRD PAPER on the proteolytic enzyme of Nepenthes,[10] Vines gives an abstract of the memoir of Clautriau[11] on digestion in the pitchers of these plants, and joins issue with him in various points. Vines holds "that the three enzymes, nepenthin, bromelin, and papain have essentially the same proteolytic action, which is tryptic," bromelin being most active, and nepenthin least. The latter also acts only in an acid medium; the others act best in a neutral one. Vines reiterates his former statement that all known proteolytic enzymes of plants are probably tryptic.— C. R. B.

THE ORIGIN of new species of plants has been recently treated from a botanical standpoint by von Wettstein.[12] He presents an extensive review of botanical literature bearing on Neo-Darwinian and Neo-Lamarckian theories, and concludes with a brief summary of his conclusions, the important points of which are as follows. High organization results from the fixing of adaptive characters by crossing and is largely modified by heterogeny; crossing and heterogeny play less important parts in the acquisition of adaptive characters; this stimulation comes through external factors, the plant having the ability to control its development by adaptation. It will be noted that this is a Neo-Lamarckian attitude.— B. M. DAVIS.

KUSANO[13] has recently made some extensive experiments on transpiration

[7] WHITNEY, Evolution and the theory of probability. Univ. Chron., Univ. of Cal. 3: 402. 1900.

[8] HABERLANDT, G., Ueber fibrilläre Plasmastructuren. Ber. Deutsch. Bot. Gesells. 19: 569–578. 29 Ja 1902.

[9] Die Reizleitung und die reizleitenden Strukturen bei den Pflanzen. Jena. 1901.

[10] Annals of Botany 15: 563–473. 1901.

[11] La digestion dans les urnes de Nepenthes. Mém. couronnés, Acad. Roy. Belg. 59: —. 1900.

[12] VON WETTSTEIN, Der gegenwärtige Stand unserer Kenntniss betreffend die Neubildung von Formen im Pflanzenreiche. Ber. Deutsch. Bot. Gesell. 18: 184. 1900.

[13] KUSANO, Transpiration of evergreen trees in winter. Jour. Coll. Sci. Tōkyō 15: 313–366. 1901.

of evergreen trees of Japan in winter. He found that the broad-leaved trees used in his experiments transpired per day 16.58^{gm} per 100^{gm} of fresh weight, and conifers 8.18^{gr}. The time of minimum transpiration agrees with that of minimum temperature, $-5.9°$ C., and occurs at the end of January. These experiments, taken with those of Miyake,[14] who has shown that photosynthesis takes place without intermission in winter, seem to indicate that the abundance of evergreen trees in Japan is chiefly due to the favorable climate. The Puget sound region has a climate much like that of Japan, which may account for its great coniferous forests also.— H. N. WHITFORD.

STARCH FORMATION in Hydrodictyon is described by Timberlake.[15] There is no sharply differentiated chromatophore in this alga, the chlorophyll being distributed generally through the protoplasm between the plasma membrane and vacuolar membrane. The numerous pyrenoids are the centers of starch formation. . Portions of the pyrenoids are cut off and changed directly into starch grains which lie in the surrounding protoplasm, arranged in such a manner as to show clearly their relation to the mother pyrenoid. The pyrenoid is then an active body contributing its substance to the starch grain. Kleb's distinction between pyrenoid and stroma starch in Hydrodictyon is not justified, for the latter are only older grains pushed away from the pyrenoids by the formation of younger starch. This study suggests interesting comparisons of other algal types with and without pyrenoids.—B. M. DAVIS.

AN ACCOUNT OF FERTILIZATION in another species of Pythium has appeared since the recent paper of Trow (Annals of Botany, Je 1901). Miyake[16] has investigated *Pythium Debaryanum*, and his results are essentially the same as those of Trow for *Pythium ultimum*. There is a mitosis in both oogonium and antheridium, the spindle being intranuclear as in Albugo. The contents of the oogonium becomes differentiated into ooplasm and periplasm, the nuclei taking position in the latter region. One nucleus enters the ooplasm from the periphery and becomes the functional female nucleus, those in the periplasm finally degenerating. There is no coenocentrum. A single male nucleus is discharged into the oogonium together with the greater part of the contents of the antheridium. Fusion of the sexual nuclei follows shortly. The investigation gives no data on the number of chromosomes in the various phases of the life-history.— B. M. DAVIS.

NOT LONG ago reference was made to the rather striking experiments of

[14] Bot. Centralb. **80**: 172.

[15] TIMBERLAKE, H. G., Starch formation in *Hydrodictyon utriculatum*. Annals of Botany **15**: 619–635. *pl. 34.* 1901.

[16] MIYAKE, K., The fertilization of *Pythium Debaryanum*. Annals of Botany **15**: 653–667. *pl. 36.* 1901.

Friedel,[17] who claimed that he had observed, apart from the living plant, the gas exchanges which are associated with photosynthesis. Macchiati[18] has discussed the significance of Friedel's results without adding many new facts of his own. Friedel[19] and Harroy[20] have repeated the earlier experiments of the former and obtained negative results. Friedel attributes this to the general weakening of synthetic processes in autumn, and promises to experiment on a large scale in the coming spring. He observed that young Pelargonium leaves show an activity in early summer that is twenty times that of similar young leaves in autumn, and that one scarcely ought to expect dead leaf material to exhibit gas exchanges at such an unfavorable period. Harroy, who repeated Friedel's experiments exactly and then improved upon the latter's experimental methods, concludes that Friedel's claim is premature, to say the least, though he admits its plausibility.— H. C. COWLES.

MITOSIS in the cells of Spirogyra presents difficulties that have led to a number of investigations with widely different results and much confusion. The last extensive paper on the subject is by Wisselingh.[21] The chief difficulties of the past have been the interpretation of nucleolus-like structures. Wisselingh finds generally one nucleolus for each nucleus, but sometimes two or more of varying sizes. Each has a membrane and contains a closely wound network, shown in certain stages of development to be made up of two long threads. The nucleolus of Spirogyra therefore shows many resemblances in structure to a nucleus. Outside of the nucleolus is a network filling the remainder of the nucleus.

There are two forms of mitosis, one with the formation of segments and one without. The segments are generally twelve in number, two coming from the nucleolus or two nucleoli, and the remainder from the nuclear network. These gather to form a nuclear plate at the metaphase of mitosis. Assuming that these segments are chromosomes, we then have in Spirogyra a form whose nucleoli are chromatic in character. However, the chemical nature of these bodies is not established, nor are all the stages of mitosis clearly explained.— B. M. DAVIS.

ITEMS OF TAXONOMIC INTEREST are as follows: R. CHODAT and E. WILCZEK (Bull. Herb. Boissier II. 2:281–296. 1902) have begun a critical enumeration of the plants of the Argentine Republic collected by Wilczek.— R. CHODAT (*idem* 297–312), in continuing his *Plantae Hasslerianae* from Paraguay, describes numerous new species of Compositae.—J. CARDOT and I. THERIOT (The Bryologist 5:13–16. 1902) have published some new and unrecorded mosses of North America.—E. L. GREENE (Ottawa Nat. 15:278–282.

[17] BOT. GAZ. 32:430. 1901.

[18] Bull. Soc. Bot. Ital. 1901: 323–335.

[19] Compt. Rend. 133:840–841. 1901.

[20] Compt. Rend. 133:890–891. 1901.

[21] WISSELINGH, Ueber Kerntheilung bei Spirogyra. II. Flora 87:355. 1900.

1902) has described new species of Aster, Gnaphalium (2), and Arnica (4) from the northwest.— F. V. COVILLE (Proc. Biol. Soc. Washington **15**: 23-29. 1902) has discussed the confused synonymy of *Ribes aureum* and *R. lentum*.—C. L. POLLARD (Torreya **2** : 24–25. 1902) has described a new violet from New Jersey, and also (Proc. Biol. Soc. Washington **15** : 19–21. 1902) five new American species of Chamaecrista.— R. S. WILLIAMS (Bull. Torr. Bot. Club **29** : 66–68. *pls. 4–5.* 1902) has described new western species of Eurhynchium and Brachythecium.— CHARLES H. PECK (*idem* 69–74) has published thirteen new species of fungi.—ALICE EASTWOOD (*idem* 75–82. *pls. 6–7*) has described new Californian species of Fritillaria, Monotropa, Cycladenia, Potentilla, Orthocarpus, Spraguea, Sidalcea, Stachys, and Trifolium.— W. H. LONG, Jr. (*idem* 110–116) has described seven new Texan species of Puccinia, with illustrations. — F. GAGNEPAIN (Bull. Soc. Bot. France IV. **1**: session extraordinaire LXXIX. 1901) has published a new genus (*Aulotandra*) of Zingiberaceae.—J. M. C.

COWLES,[22] in a very comprehensive paper, gives the results of his observations on the influence of rocks on vegetation. The physical and chemical causes for different vegetation on different rocks is discussed. Attention is called to the facts that the resemblances, and not the differences, are the most striking, and that a number of factors have hitherto been neglected. Siliceous and calcareous rocks give rise to siliceous soils, so that there is more uniformity in the soils produced than in the rocks from which they were derived. The physiographic factor has also been neglected. No matter what the kind of rock, the ecological conditions will be much the same in the initial stages of erosion, and consequently the plants will be similar, while in the last stages of the life history the plants and conditions will be exactly the same. "The vegetation of all hills in a given region, of whatever chemical or physical nature, is tending toward an ultimate common destiny, which in most parts parts of the United States is the mesophytic forest. The succession of plant societies is sometimes slow and sometimes fast, and hence we have at any given period before the ultimate stage is reached a difference in soils. Were the stages equally rapid in all cases, there would be no such differences."

The author's researches comprise studies made on granites, gneisses, basalts, etc., in northern Michigan and in Connecticut, on quartzites in northern Michigan and in Montana, sandstones in northern Michigan, northern Illinois and in eastern Tennessee, shales in the Cumberland mountains of eastern Tennessee, and limestone and dolomites in Illinois, Wisconsin, Tennessee, and Montana.— H. N. WHITFORD.

[22] COWLES, H. C., Contributions from the Hull botanical laboratory. XXXIV. Bull. Am. Bureau Geog. **2** : 163–176, 376–388. 1901.

PROFESSOR HEGLER'S work on the Cyanophyceae[23] has been expected ever since 1895, but poor health delayed the investigation. After the author's death, the manuscript, quite ready for the press, was published by Professor G. Karsten, who states that after the appearance of A. Fischer's work the author most carefully re-examined the disputed points, but without deeming it necessary to change his views. The photomicrographs with which the paper is illustrated do but scant justice to the beautiful preparations which the reviewer had the privilege of examining. About forty pages are devoted to a critical review of the literature of the subject. The rest of the paper, about eighty pages, contains an account of Hegler's prolonged investigations. The principal conclusions are as follows. There are no naked protoplasts in the Cyanophyceae, all cells being provided with cell membranes, which in the heterocysts consist of cellulose, and in the other cells consist principally of chitin. In the protoplast, or cell contents, may be distinguished an outer color-containing layer and an inner colorless portion. The coloring matter is in the form of extremely small granules so closely crowded as to give the impression of an homogeneous color. The chlorophyll and phycocyan are contained in the same granules and these granules are to be regarded as the chromatophores of the Cyanophyceae. Starch or starch-like material is not present, but glycogen can be identified and is the first recognizable product of assimilation. Albuminoid crystals and slime vacuoles are never found in the colorless, central portion of the cell. The albuminoid crystals are particularly abundant in the heterocysts and spores, but are often entirely lacking in rapidly-growing vegetative cells.

Whether a nucleus is present or not is the most important morphological question in connection with the Cyanophyceae and bacteria, since these are the only organisms in which a nucleus has not been positively identified. The bearing of this question upon present morphological theories of heredity is evident. Since previous methods have failed to solve the problem, the author devoted much attention to fixing and staining, and recommends the following: Saturated aqueous solution of SO^2, 7 parts; 94 per cent. alcohol, 93 parts; mix just before using and fix for 12–24 hours; wash with alcohol. Another fixing agent that gives good results is: 40 per cent. formalin, 5 parts; 94 per cent. alcohol, 95 parts; wash in 50 per cent. alcohol. The first-named fixing agent, however, allows a sharper staining of the nuclear figures. Fuchsin, safranin, and gentian-violet do not stain well; iodine-green and methyl-blue are better. The following method gave the best results: crystals of ammonia alum, 75 parts; water, 750 parts; dissolve the crystals in water, and add glycerin 125 parts, 94 per cent. alcohol 100 parts, and saturated alcoholic solution of haematoxylin 25 parts.

[23] HEGLER, ROBERT, Untersuchungen über die Organization der Phycochromaceenzelle. Jahrb. Wiss. Bot. **36**: 229–254. *pls. 5–6.* 1901.

The solution must stand for several weeks in a beaker, covered only by a piece of filter paper, before it is ready for use. Then stain for 24 hours in a mixture of 10 parts of the above solution in 100 parts of a 1 per cent. aqueous solution of formalin. Wash in running water at least one hour and then differentiate in saturated alcoholic solution of picric acid 1 part, water 1 part, and 94 per cent. alcohol 2 parts. The differentiation will generally require only a few seconds. Rinse in 75 per cent. alcohol and examine. If still too deeply stained transfer again to the differentiating solution and so continue until the stain is clear and sharp, then wash in running water for an hour, transfer to 50, 75, 94 per cent., and absolute alcohol, clear in toluol and mount in dammar.

From such preparations the following conclusions are drawn. The Centralkörper, or central body of the Cyanophyceae, is a nucleus. The most important reason for this conclusion is the behavior of the central body during cell division. In all cells of the Cyanophyceae, except the heterocysts, the nuclei of which degenerate very early, a single nucleus is present, its form depending largely upon the shape of the cell. The resting nucleus consists of a slightly staining ground mass in which are imbedded numerous, deeply staining granules. These granules from their behavior during division, their reaction to stains and digestive fluids, are to be identified with the chromatin granules of higher plants. They are not the "red granules" of Bütschli. The nucleus differs from that of higher plants in not possessing a nucleolus or nuclear membrane. During nuclear division the granules fuse into chromosomes which separate as division proceeds. Strands which represent spindle fibers may be seen between the separating groups. The wall first appears as a ring midway between the daughter nuclei and gradually grows toward the center until the partition is complete. The writer believes that he has shown positively that the Centralkörper is to be identified with the nucleus of higher plants.

It is interesting to note that Zacharias, in a lengthy and somewhat prejudiced review of Hegler's paper (Bot. Zeit. 59 : 322–327. 1901) disputes the accuracy of these conclusions and insists that there is no nucleus in the Cyanophyceae.—CHARLES J. CHAMBERLAIN.